اعداد شادي داهشي : شعبة الاتصالات (١- 2)

تم الرفع بواسطة م. معن ابو عيسى

Circuit 1
First

Specialization:	Engineering (General)		**Palestinian National Authority** **Ministry Education & Higher Education** **Palestine Technical University** **College of Engineering & Technology**
Course Name:	Electric Circuits Electric Circuits 1		
Date:	18/10/2010		
Time:	11:00-12:00		First Exam First semester 2010/2011
Instructor:	م. محمود الاحمد		

Name: [redacted] معن سلام قعدان	Section: اعداد شادي خميس 2-1	Mark:	21 /25

Please answer ***all*** the following 5 questions

Q1. *(7 marks)* Using mesh analysis, find the power of the 12 volts source

العلامة 21/25

$i_1 = 4A$

Mesh ② :

$2(i_2 - i_1) + 0.5V_x + 1(i_2 - i_4) = 0$

$V_x = 2(i_3 - i_1) = 2(i_3 - 4)$

$\therefore 2(i_2 - 4) + 0.5(2(i_3 - 4)) + i_2 - i_4 = 0$

$2i_2 - 8 + i_3 - 4 + i_2 - i_4 = 0$

$3i_2 + i_3 - i_4 - 8 - 4 = 0 \Rightarrow 3i_2 + i_3 - i_4 = 12$ — ①

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Mesh ④ :- $1(i_4 - i_2) + 12 + 1(i_4 - i_3) = 0$

$i_4 - i_2 + 12 + i_4 - i_3 = 0$

$-i_2 - i_3 + 2i_4 = -12$ — ②

$I_x = i_4 - i_2$

Mesh ③ :- $2(i_3 - 4) + 1(i_3 - i_4) - I_x = 0$

$2(i_3 - 4) + 1(i_3 - i_4) - (i_4 - i_2) = 0$

$2i_3 - 8 + i_3 - i_4 - i_4 + i_2 = 0$

$i_2 + 3i_3 - 2i_4 = 8$ — ③

$$\begin{bmatrix} 3 & 1 & -1 \\ -1 & -1 & 2 \\ 1 & 3 & -2 \end{bmatrix} \begin{bmatrix} i_2 \\ i_3 \\ i_4 \end{bmatrix} = \begin{bmatrix} 12 \\ -12 \\ 8 \end{bmatrix}$$

$$\Delta = \begin{vmatrix} 3 & 1 & -1 \\ -1 & -1 & 2 \\ 1 & 3 & -2 \end{vmatrix} = 3\begin{vmatrix} -1 & 2 \\ 3 & -2 \end{vmatrix} - 1\begin{vmatrix} -1 & 2 \\ 1 & -2 \end{vmatrix} + -1\begin{vmatrix} -1 & -1 \\ 1 & 3 \end{vmatrix} = 3(-4) - 0 + -1(-2) = -12 + 0 + 2 = \boxed{-10}$$

$$\Delta_2 = \begin{vmatrix} 12 & 1 & -1 \\ -12 & -1 & 2 \\ 8 & 3 & -2 \end{vmatrix} = 12\begin{vmatrix} -1 & 2 \\ 3 & -2 \end{vmatrix} - 1\begin{vmatrix} -12 & 2 \\ 8 & -2 \end{vmatrix} - 1\begin{vmatrix} -12 & -1 \\ 8 & 3 \end{vmatrix} = 12(-4) - 1(8) - 1(-28) = -48 - 8 + 28 = \boxed{-28}$$

$$\Delta_3 = \begin{vmatrix} 3 & 12 & -1 \\ -1 & -12 & 2 \\ 1 & 8 & -2 \end{vmatrix} = 3\begin{vmatrix} -12 & 2 \\ 8 & -2 \end{vmatrix} - 12\begin{vmatrix} -1 & 2 \\ 1 & -2 \end{vmatrix} - 1\begin{vmatrix} -1 & -12 \\ 1 & 8 \end{vmatrix} = 3(8) - 12(0) - 1(4) = 24 - 0 - 4 = \boxed{20}$$

خلف الصفحة →

$-8 + 12$

~~$-3 = -1 \quad -3+1 = -2 \qquad -8 = -12 \quad -8+12 = 4 \qquad \ldots -3 \quad 8+36 = -88$~~

Q1 2.5

$$\Delta 4 = \begin{vmatrix} 3 & 1 & 12 \\ -1 & -1 & -12 \\ 1 & 3 & 8 \end{vmatrix} = 3\begin{vmatrix} -1 & -12 \\ 3 & 8 \end{vmatrix} - 1\begin{vmatrix} -1 & -12 \\ 1 & 8 \end{vmatrix} + 12\begin{vmatrix} -1 & -1 \\ 1 & 3 \end{vmatrix}$$

$$= 3(+28) - 1(4) + 12(-2)$$

$$= +84 - 4 - 24 = \boxed{56}$$

$\therefore i_1 = \boxed{4A}$

$\therefore i_2 = \frac{\Delta 2}{\Delta} = \frac{-28}{-10} = \boxed{2.8\,A}$

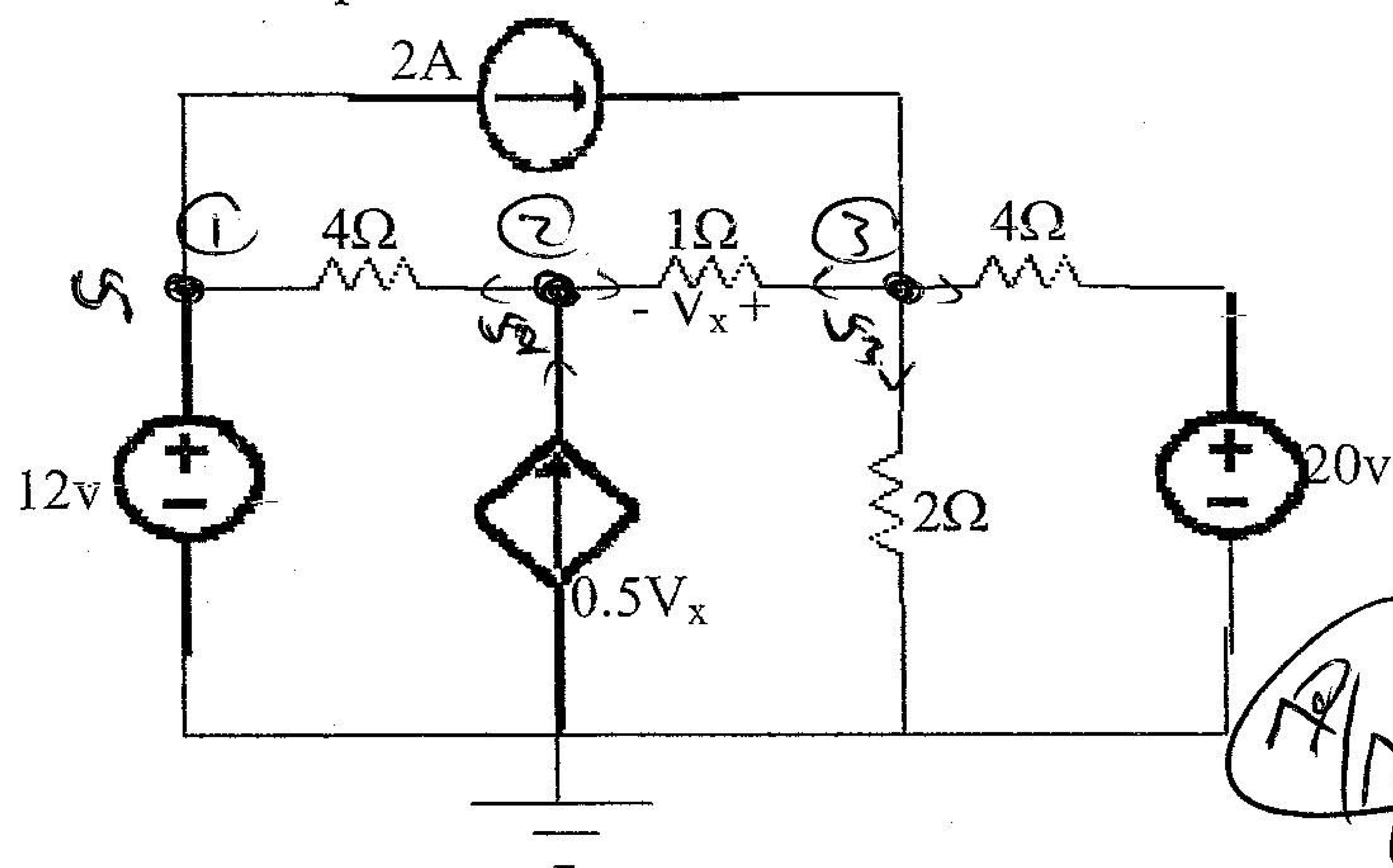
$\therefore i_3 = \frac{\Delta 3}{\Delta} = \frac{20}{-10} = \boxed{-2\,A}$

$\therefore i_4 = \frac{\Delta 4}{\Delta} = \frac{56}{-10} = \boxed{-5.6\,A}$

$P_{12V} = IV = (-5.6)(12) = \boxed{-67.2 \text{ watt}}$

generates

Q2. *(7 marks)* Using nodal analysis, find the power of the dependent source



$v_1 = 12\,v$

node ② :-

$$0.5\,v_x = \frac{v_2 - v_3}{1} + \frac{v_2 - 12}{4} \qquad v_x = v_3 - v_2$$

$$0.5\,(v_3 - v_2) = \frac{v_2 - v_3}{1} + \frac{v_2 - 12}{4} \quad \times 4$$

$$2\,(v_3 - v_2) = 4v_2 - 4v_3 + v_2 - 12$$

$$2v_3 - 2v_2 = 4v_2 - 4v_3 + v_2 - 12$$

$$4v_2 - 4v_3 - 2v_3 + 2v_2 + v_2 = 12$$

$$7v_2 - 6v_3 = 12 \quad \text{— (1)}$$

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node ③ :

$$2 = \frac{v_3 - v_2}{1} + \frac{v_3}{2} + \frac{v_3 - 20}{4} \quad \times 4$$

$$8 = 4v_3 - 4v_2 + 2v_3 + v_3 - 20$$

$$20 + 8 = 4v_3 - 4v_2 + 2v_3 + v_3$$

$$7v_3 - 4v_2 = 28$$

$$-4v_2 + 7v_3 = 28 \quad \text{— (2)}$$

$$\begin{bmatrix} 7 & -6 \\ -4 & 7 \end{bmatrix} \begin{bmatrix} v_2 \\ v_3 \end{bmatrix} = \begin{bmatrix} 12 \\ 28 \end{bmatrix}$$

$$\Delta = \begin{vmatrix} 7 & -6 \\ -4 & 7 \end{vmatrix} = 49 - (+24) = \boxed{25}$$

$$\Delta_2 = \begin{vmatrix} 12 & -6 \\ 28 & 7 \end{vmatrix} = 84 - (-168) = 84 + 168 = \boxed{252}$$

$$\Delta_3 = \begin{vmatrix} 7 & 12 \\ -4 & 28 \end{vmatrix} = 196 - (-48) = \boxed{244}$$

$$\therefore v_2 = \frac{\Delta_2}{\Delta} = \frac{252}{25} = \boxed{10.08\,V}$$

$$\therefore v_3 = \frac{\Delta_3}{\Delta} = \frac{244}{25} = \boxed{9.76\,V}$$

الحل بالصفحة →

Q2 &b

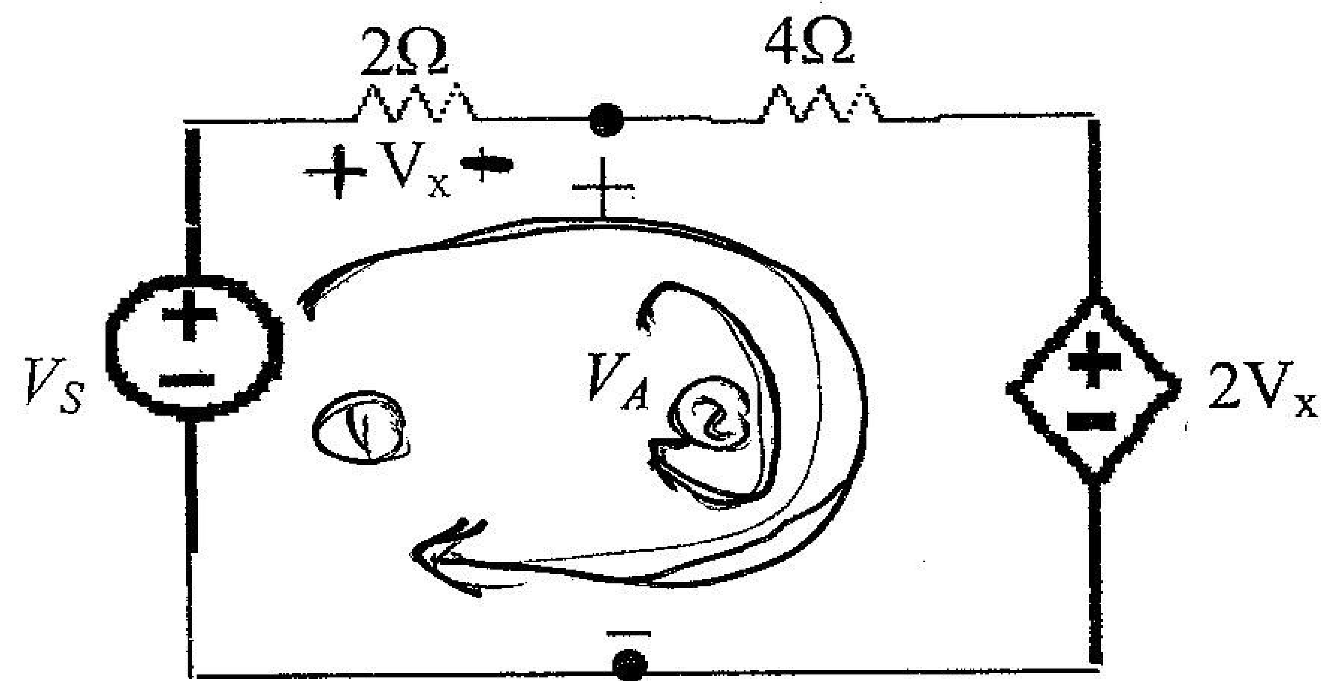
$v_x = v_3 - v_2 = 9.76 - 10.08 = \boxed{-0.32\ V}$

dependent Source $= 0.5 v_x = 0.5(-0.32) = \boxed{-0.16\ A}$

$P_{0.5 v_x} = I V_2 = (-0.16)(10.08) =$ ~~1.61218~~ $\boxed{-1.6128\ \text{Watt}}$

generates

Q3. *(3 marks)* In the circuit shown below, if $V_A = 12volt$, find V_S



Loop ① :-

$-V_S + 2i_1 + 4i_1 + 2V_x = 0$

$V_x = 2i_1$

$\therefore -V_S + 2i_1 + 4i_1 + 2(2i_1) = 0$

$-V_S + 2i_1 + 4i_1 + 4i_1 = 0$

$-V_S + 10i_1 = 0$

Loop ② :-

$V_A + 4i_1 + 2V_x = 0$

$12 + 4i_1 + 2(2i_1) = 0$

$12 + 4i_1 + 4i_1 = 0$

$12 + 8i_1 = 0 \Rightarrow i_1 = \frac{-12}{8} = -1.5A$

3/3

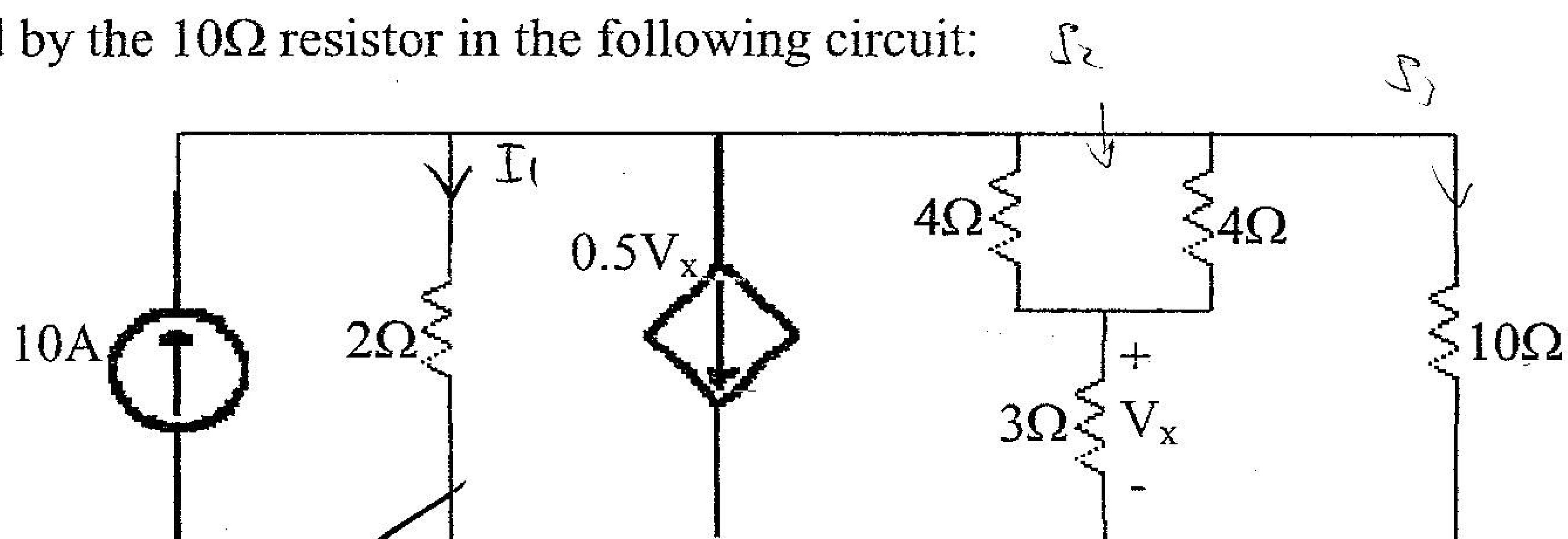
$\therefore -V_S + 10i_1 = 0$

$-V_S + 10(-1.5) = 0$

$-V_S - 15 = 0$

$V_S = -15\ V$

Q4. *(4 marks)* Find the power absorbed by the 10Ω resistor in the following circuit:



$4 \parallel 4 = \frac{4 \times 4}{4+4} = \frac{16}{8} = 2\Omega$

~~$10 = I_1 + 0.5 V_x + I_2 + I_3$~~

~~$10 = \frac{v}{2} + 0.5 V_x + \frac{v}{5} + \frac{v}{10}$~~

⇓

I_1 I_2 I_3

0.5Vx 2 10 3 + Vx −

$V_x = 3 I_2 = 3 \left(\frac{v}{5}\right) = \frac{3}{5} v$

~~$10 = \frac{v}{2} + \frac{3}{5} v + \frac{v}{5} + \frac{v}{10}$~~

∴ $0.5 V_x = \frac{1}{2}\left(\frac{3}{5} v\right) = \frac{3}{10} v$

4/4

∴ $10 = \frac{v}{2} + \frac{3}{10} v + \frac{v}{5} + \frac{v}{10}$ × 10

$100 = 5v + 3v + 2v + v$ ——— (1)

~~$100 = 56v \Rightarrow v = \frac{100}{56} = 1.785$ Volts~~

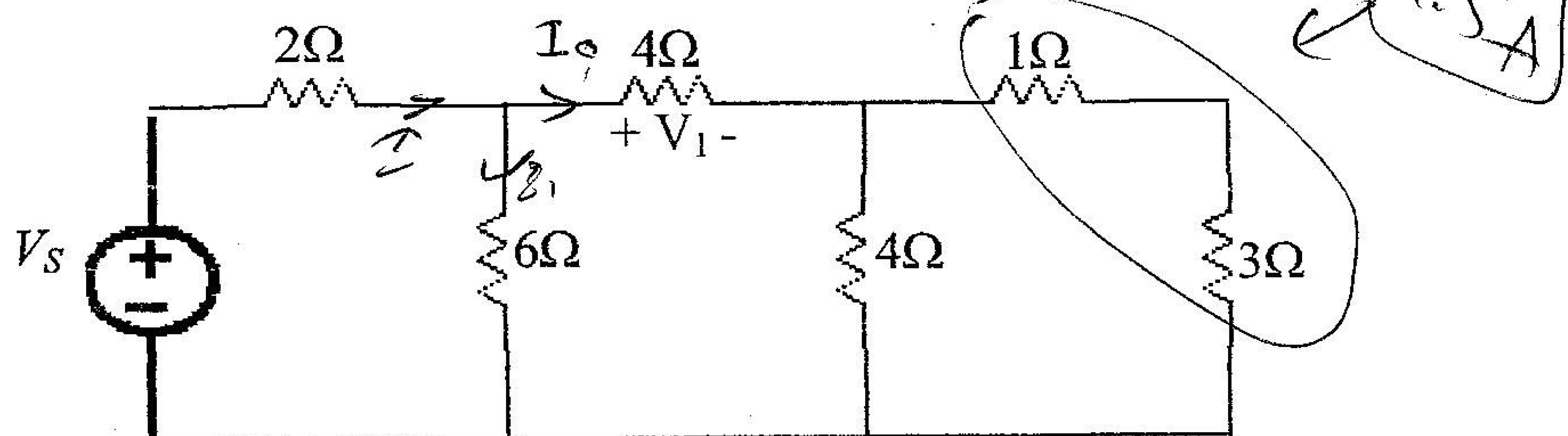
$100 = 11 v \Rightarrow v = \frac{100}{11} = 9.09$ Volts

∴ $P_{10\Omega} = \frac{V^2}{R} = \frac{(9.09)^2}{10} = 8.26$ Watt

absorbs

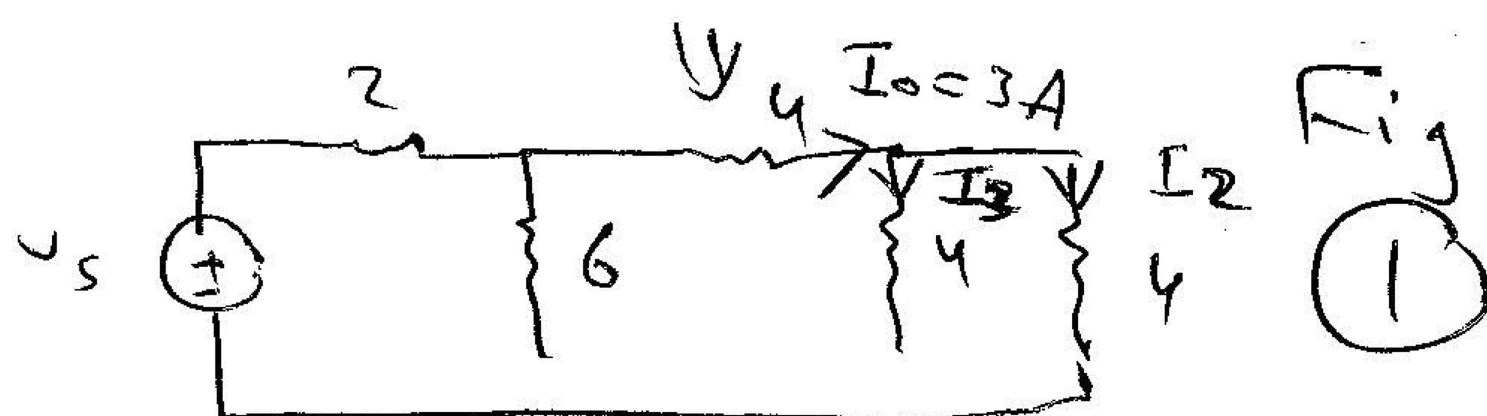
∴ $V_x = \frac{3}{10} v = \frac{3}{10}(9.09) = 2.72$ Volts

Q5. *(4 marks)* In the circuit shown below if $V_1 = 12 volt$, find V_S and the power of 3Ω resistor



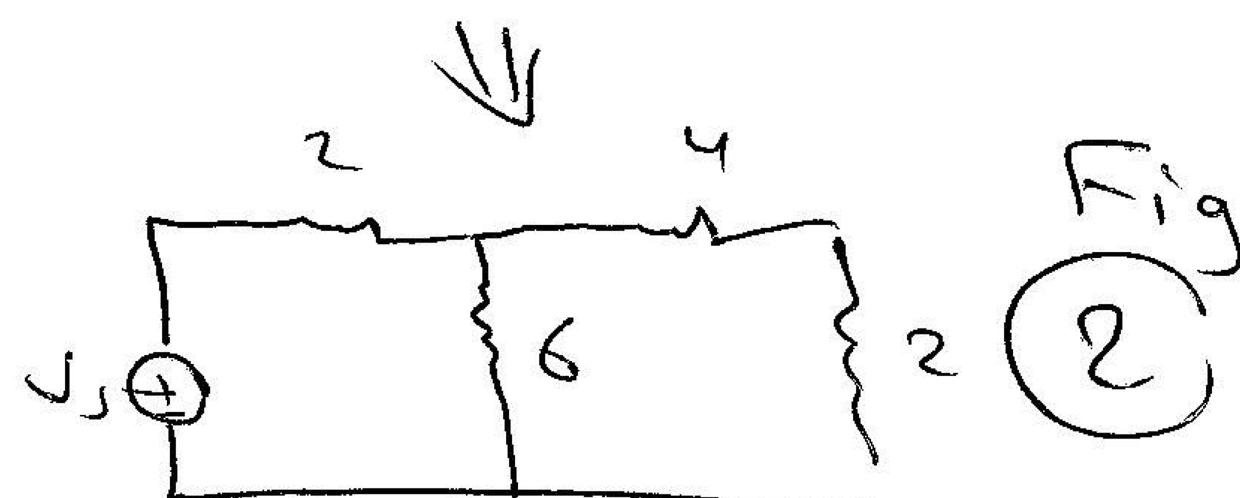
$V_1 = 12\,V$

$\therefore I_o = \frac{12}{4} = \boxed{3\,A}$



$1+3$ (Series) $= \boxed{4\,\Omega}$

$4 \,//\, 4 = \frac{4\times4}{4+4} = \frac{16}{8} = \boxed{2\,\Omega}$



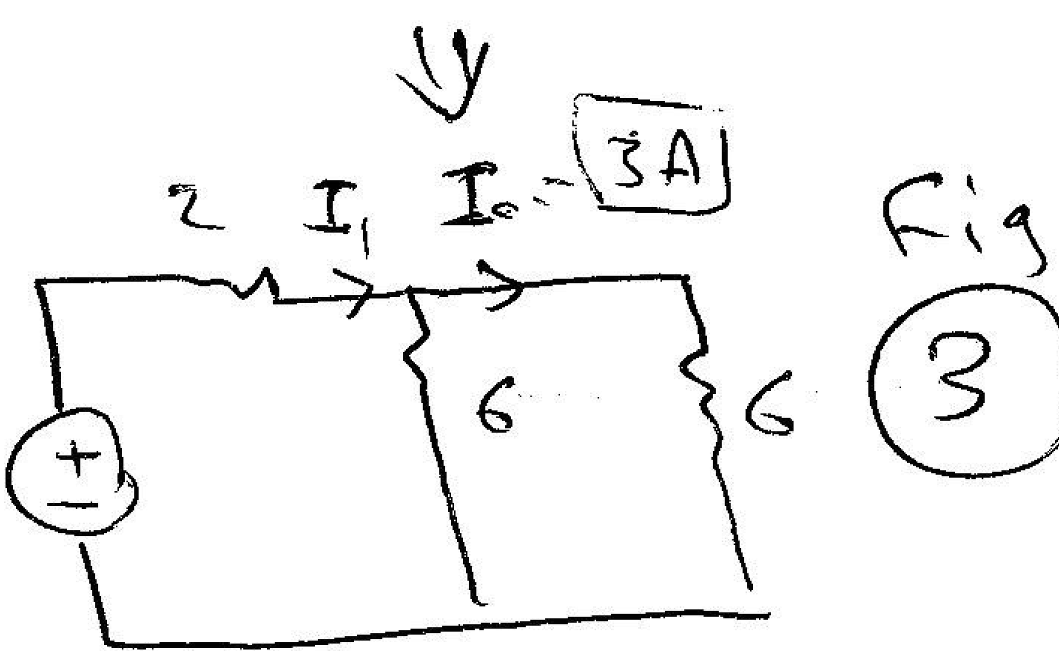
$2+4$ (series) $= 6\,\Omega$

$\boxed{I_o = 3\,A}$

$3 = I_1 \left(\frac{6}{6+6}\right)$

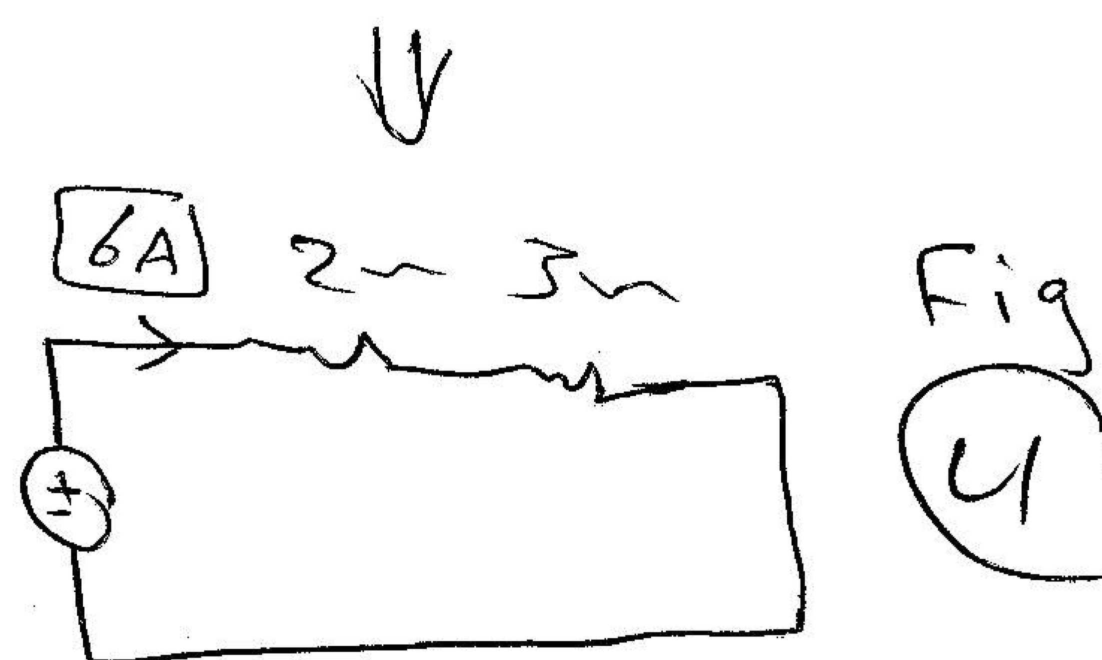
$3 = \frac{6}{12} I_1$

$\therefore 3 = 0.5 I_1 \Rightarrow I_1 = \boxed{6\,A}$



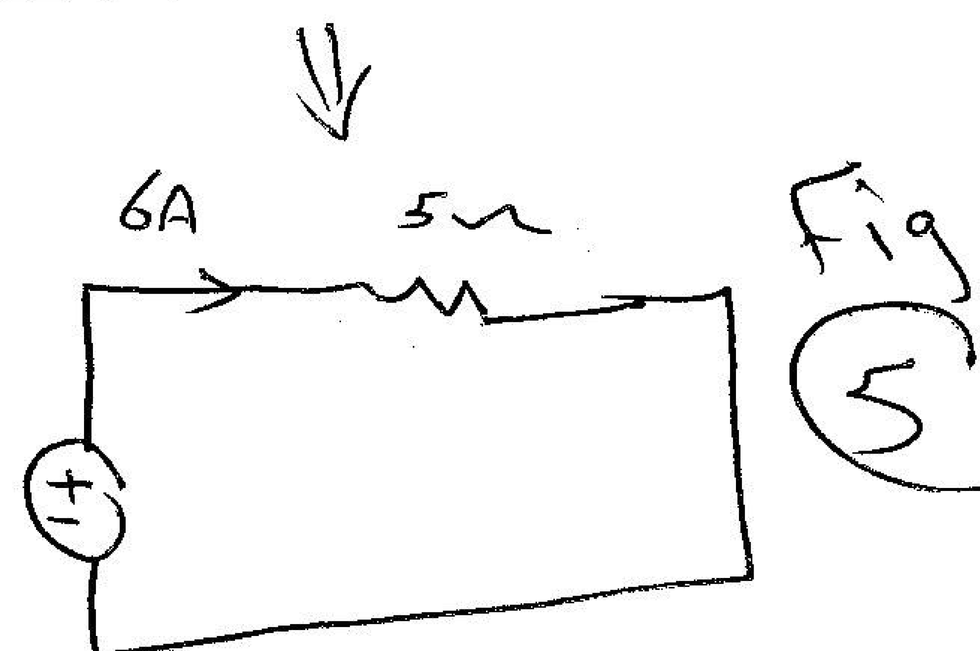
4/4

$6 \,//\, 6 = \frac{6\times6}{6+6} = \frac{36}{12} = 3\,\Omega$



$(3+2)$ Series $= 5\,\Omega$

$\therefore V_S = (6\,A)(5\,\Omega) = \boxed{30\,V}$



Look to Fig ①

$I_2 = 3\left(\frac{4}{4+4}\right) = 3\left(\frac{4}{8}\right) = \boxed{1.5\,A}$

$\therefore$ Current in $1\,\Omega$ and $3\,\Omega$ is $\boxed{1.5\,A}$

Good Luck

$\therefore P_{3\Omega} = I^2 R = (1.5)^2 (3) = \boxed{6.75\ \text{watt}}$ absorbs